CLAIMS

What is claimed is:

1. A nuclear voltaic cell comprising:

a first substrate having a first surface;

a layer of fissile material deposited on said first surface of said first substrate;

a first metallic contact layer deposited on said layer of fissile material;

a second substrate having a first surface;

a second metallic contact layer deposited on said first surface of said second substrate, wherein said first substrate and said second substrate are positioned so that said first metallic contact layer and said second metallic contact layer are facing each other;

a liquid semiconductor interposed in between said first metallic contact layer and said second metallic contact layer, wherein said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor; and

an electrical circuit connecting said first metallic contact layer to said second metallic contact layer.

2. A nuclear voltaic cell according to claim 1, wherein electrical power is generated when an electrical load is applied to said electrical circuit.

3. A nuclear voltaic cell according to claim 1, wherein said liquid semiconductor is a p-type semiconductor.

4. A nuclear voltaic cell according to claim 1, wherein said liquid semiconductor is an n-type semiconductor.

5. A nuclear voltaic cell according to claim 1, wherein a plurality of nonconductive spacers are placed between said first metallic contact layer and said second metallic contact layer with said liquid semiconductor interspersed there between.

6. A nuclear voltaic cell according to claim 1, wherein said liquid semiconductor flows between said first metallic contact layer and said second metallic contact layer.

7. A nuclear voltaic cell according to claim 1, wherein said first substrate and second substrate are axially opposed to each other and are wound around a mandrel.

8. A nuclear voltaic cell comprising:

a first substrate having a first surface;

a layer of radioactive isotope deposited on said first surface of said first substrate;

a first metallic contact layer deposited on said layer of radioactive isotope;

a second substrate having a first surface;

a second metallic contact layer deposited on said first surface of said second substrate, wherein said first substrate and said second substrate are positioned so that said first metallic contact layer and said second metallic contact layer are facing each other;

a liquid semiconductor interposed in between said first metallic contact layer and said second metallic contact layer, wherein said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor; and

an electrical circuit connecting said first metallic contact layer to said second metallic contact layer.

9. A nuclear voltaic cell according to claim 8, wherein electrical power is generated when an electrical load is applied to said electrical circuit.

10. A nuclear voltaic cell according to claim 8, wherein said liquid semiconductor is a p-type semiconductor.

11. A nuclear voltaic cell according to claim 8, wherein said liquid semiconductor is an n-type semiconductor.

12. A nuclear voltaic cell according to claim 8, wherein a plurality of nonconductive spacers are placed between said first metallic contact layer and said second metallic contact layer with said liquid semiconductor interspersed there between.

13. A nuclear voltaic cell according to claim 8, wherein said radioactive isotope is at least one of an alpha particle, beta particle or gamma ray emitter.

14. A nuclear voltaic cell according to claim 8, wherein said liquid semiconductor flows between said first metallic contact layer and said second metallic contact layer.

15. A nuclear voltaic cell according to claim 8, wherein said first substrate and second substrate are axially opposed to each other and are wound around a mandrel.

16. A nuclear voltaic cell comprising:

a first metallic contact layer, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said liquid semiconductor contains a solution of fissile material and said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor; and

an electrical circuit connecting said first metallic contact layer to said second metallic contact layer.

17. A nuclear voltaic cell according to claim 16, wherein electrical power is generated when an electrical load is applied to said electrical circuit.

18. A nuclear voltaic cell according to claim 16, wherein said liquid semiconductor is a p-type semiconductor.

19. A nuclear voltaic cell according to claim 16, wherein said liquid semiconductor is an n-type semiconductor.

20. A nuclear voltaic cell according to claim 16, wherein a plurality of nonconductive spacers are placed between said first metallic contact layer and said second metallic contact layer with said liquid semiconductor interspersed there between.

21. A nuclear voltaic cell according to claim 16, wherein said liquid semiconductor flows between said first metallic contact layer and said second metallic contact layer.

22. A nuclear voltaic cell according to claim 16, wherein said first substrate and second substrate are axially opposed to each other and are wound around a mandrel.

23. A nuclear voltaic cell comprising:

a first metallic contact layer, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said liquid semiconductor contains a solution of a radioactive isotope and said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor; and

an electrical circuit connecting said first metallic layer to said second metallic layer.

24. A nuclear voltaic cell according to claim 23, wherein electrical power is generated when an electrical load is applied to said electrical circuit.

25. A nuclear voltaic cell according to claim 23, wherein said liquid semiconductor is a p-type semiconductor.

26. A nuclear voltaic cell according to claim 23, wherein said liquid semiconductor is an n-type semiconductor.

27. A nuclear voltaic cell according to claim 23, wherein a plurality of nonconductive spacers are placed between said first metallic contact layer and said second metallic contact layer with said liquid semiconductor interspersed there between.

28. A nuclear voltaic cell according to claim 23, wherein said liquid semiconductor flows between said first metallic contact layer and said second metallic contact layer.

29. A nuclear voltaic cell according to claim 23, wherein said first substrate and second substrate are axially opposed to each other and are wound around a mandrel.

30. A nuclear voltaic array comprising a plurality of nuclear voltaic cells arranged into a stack, said stack comprising at least:

a first layer comprising a substrate having a first surface, wherein a coating of fissile material is deposited on said first surface, and further wherein a coating of a first metallic contact is deposited on said coating of fissile material;

a second layer comprising a liquid semiconductor, wherein said second layer is adjacent to and in contact with said first layer, wherein said first metallic contact forms a Schottky contact with said liquid semiconductor in said second layer;

a third layer comprising a substrate having deposited on its two planar surfaces a second metallic contact and a third metallic contact, wherein said second metallic contact of said third layer is adjacent to and in contact with said second layer, and further wherein said second metallic contact forms a low resistance or ohmic contact with said liquid semiconductor in said second layer;

a fourth layer comprising a liquid semiconductor, wherein said fourth layer is adjacent to and in contact with said third metallic contact of said third layer and forms a low resistance or ohmic contact with said liquid semiconductor in said fourth layer; and

a fifth layer comprising a third substrate having coated on a first surface a coating of fissile material, wherein said coating of fissile material is coated with a fourth metallic contact, and further wherein said fourth metallic contact of said fifth layer is adjacent to and in contact with said fourth layer and forms a Schottky contact with said liquid semiconductor in said fourth layer.

31. A nuclear voltaic array according to claim 30, wherein each of said metallic contacts is connected together by an electrical circuit.

32. A nuclear voltaic array according to claim 30, wherein electrical power is generated when a load is applied to said electrical circuit.

33. A nuclear voltaic array according to claim 30, wherein said liquid semiconductor is a p-type semiconductor.

34. A nuclear voltaic array according to claim 30, wherein said liquid semiconductor is an n-type semiconductor.

35. A nuclear voltaic array according to claim 30, wherein a plurality of nonconductive spacers are placed between said first metallic contact layer and said second metallic contact layer with said liquid semiconductor interspersed there between.

36. A nuclear voltaic array according to claim 30, wherein said liquid semiconductor flows between said first metallic contact layer and said second metallic contact layer.

37. A nuclear voltaic battery comprising a plurality of nuclear voltaic cells arranged into a stack, said stack comprising at least:

a first layer comprising a substrate having a first surface, wherein a coating of radioactive isotope is deposited on said first surface, and further wherein a coating of a first metallic contact is deposited on said coating of radioactive isotope;

a second layer comprising a liquid semiconductor, wherein said second layer is adjacent to and in contact with said first layer, wherein said first metallic contact forms a Schottky contact with said liquid semiconductor in said second layer;

a third layer comprising a substrate having deposited on its two planar surfaces a second metallic contact and a third metallic contact, wherein said second metallic contact of said third layer is adjacent to and in contact with said second layer, and further wherein said second metallic contact forms a low resistance or ohmic contact with said liquid semiconductor in said second layer;

a fourth layer comprising a liquid semiconductor, wherein said fourth layer is adjacent to and in contact with said third metallic contact of said third layer and forms a low resistance or ohmic contact with said liquid semiconductor in said fourth layer; and

a fifth layer comprising a third substrate having coated on a first surface a layer of radioactive isotope, wherein said coating of radioactive isotope is coated with a fourth metallic contact, and further wherein said fourth metallic contact of said fifth layer is adjacent to and in contact with said fourth layer and forms a Schottky contact with said liquid semiconductor in said fourth layer.

38. A nuclear voltaic battery according to claim 37, wherein each of said metallic contacts are connected together by an electrical circuit.

39. A nuclear voltaic battery according to claim 37, wherein electrical power is generated when an electrical load is applied to said electrical circuit.

40. A nuclear voltaic battery according to claim 37, wherein said liquid semiconductor is a p-type semiconductor.

41. A nuclear voltaic battery according to claim 37, wherein said liquid semiconductor is an n-type semiconductor.

42. A nuclear voltaic battery according to claim 37, wherein a plurality of nonconductive spacers are placed between said first metallic contact layer and said second metallic contact layer with said liquid semiconductor interspersed there between.

43. A nuclear voltaic battery according to claim 37, wherein said liquid semiconductor flows between said first metallic contact layer and said second metallic contact layer.

44. A nuclear voltaic battery, comprising a plurality of nuclear voltaic cells arranged into a stack, said stack comprising at least:

a first substrate having on its surface a first metallic contact layer;

a second substrate having on its surface a second metallic contact layer;

said first substrate and said second substrate are positioned so that said first metallic contact layer and said second metallic contact layer are facing each other with a channel between said first metallic contact layer and said second metallic contact layer, wherein said channel between said first metallic contact layer and said second metallic contact layer has a first end and a second end;

a liquid semiconductor interposed in said channel between said first metallic contact layer and said second metallic contact layer, wherein said first metallic contact layer forms a Schottky contact with the liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor;

said liquid semiconductor containing a solution of a radioactive isotope;

a closed loop connecting said first end of said channel between said first metallic contact layer and said second metallic contact layer to said second end of said channel between said first metallic contact layer and said second metallic contact layer; and

a pump connected to said closed loop for pumping said liquid semiconductor through said channel between said first metallic contact layer and said second metallic contact layer and through said closed loop.

45. A nuclear voltaic battery according to claim 44, further comprising a heat extractor connected to said closed loop, wherein said liquid semiconductor flows through said heat extractor and is cooled by said heat extractor.

46. A nuclear voltaic reactor core, comprising a plurality of nuclear voltaic cells arranged into a stack, said stack comprising at least:

a first substrate having on its surface a first metallic contact layer;

a second substrate having on its surface a second metallic contact layer;

said first substrate and said second substrate are positioned so that said first metallic contact layer and said second metallic contact layer are facing each other with a channel between said first metallic contact layer and said second metallic contact layer, wherein said channel between said first metallic contact layer and said second metallic contact layer has a first end and a second end;

a liquid semiconductor interposed in said channel between said first metallic contact layer and said second metallic contact layer, wherein said first metallic contact layer forms a

Schottky contact with the liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with the liquid semiconductor;

said liquid semiconductor containing a solution of fissile material;

a closed loop connecting said first end of said channel between said first metallic contact layer and said second metallic contact layer to said second end of said channel between said first metallic contact layer and said second metallic contact layer; and

a pump connected to said closed loop for pumping said liquid semiconductor through said channel between said first metallic contact layer and said second metallic contact layer and through said closed loop.

47. A nuclear voltaic reactor core according to claim 46, further comprising a heat extractor connected to said closed loop, wherein said liquid semiconductor flows through said heat extractor and is cooled by said heat extractor.

48. A nuclear voltaic reactor core according to claim 46, further comprising a scrubber connected to said closed loop, wherein said liquid semiconductor flows through said scrubber and a portion of unwanted fission fragments and neutron activation products are removed from said liquid semiconductor by said scrubber.

49. A nuclear voltaic cell array comprising a plurality of nuclear voltaic cells, wherein:

said plurality of nuclear voltaic cells are stacked on top of each other with a perforated metal sheet conductor placed between each of said plurality of nuclear voltaic cells.

50. A nuclear voltaic cell array according to claim 49, wherein each of said perforated metal sheet conductors is connected together by an electrical circuit.

51. A nuclear voltaic cell array according to claim 50, wherein electrical power is generated when a load is applied to said electrical circuit.

52. A nuclear voltaic cell array according to claim 51, wherein said plurality of nuclear voltaic cells each comprise at least a first metallic contact layer with a layer of fissile material deposited thereon, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor.

53. A nuclear voltaic cell array according to claim 51, wherein said plurality of nuclear voltaic cells each comprise at least a first metallic contact layer with a layer of radioactive isotope deposited thereon, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said first metallic contact layer forms a Schottky contact with said

liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor.

54. A nuclear voltaic cell array according to claim 51, wherein said plurality of nuclear voltaic cells each comprise at least a first metallic contact layer, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said liquid semiconductor contains a solution of fissile material and said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor.

55. A nuclear voltaic cell array according to claim 51, wherein said plurality of nuclear voltaic cells each comprise at least a first metallic contact layer, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said liquid semiconductor contains a solution of a radioactive isotope and said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor

56. A nuclear voltaic cell reactor core, said core comprising at least:

a nuclear voltaic cell array having a high concentration of fissile material therein for attainment of self-sustained nuclear reaction;

a first closed loop connected to said nuclear voltaic cell array through which a liquid semiconductor in the nuclear voltaic cell array flows;

a second closed loop connected to said nuclear voltaic cell array through which a coolant flows; and

a first heat exchanger connected to said first closed loop and a second heat exchanger connected to said second closed loop, wherein heat is removed from said liquid semiconductor and said coolant when they flow through said first and said second heat exchangers.

57. A nuclear voltaic cell reactor core according to claim 56, wherein a dynamic refueling port is connected to said first closed loop, wherein fissile material is added to said liquid semiconductor as it flows through said dynamic refueling port.

58. A nuclear voltaic cell reactor core according to claim 57, further comprising a scrubber connected to said first closed loop, wherein said liquid semiconductor flows through said scrubber and a portion of fission fragments and neutron activation products are removed from said liquid semiconductor by said scrubber.

59. A nuclear voltaic cell reactor core, said core comprising at least:

a nuclear voltaic cell array;

a coolant loop divided into two sections by a first oscillating valve between a cold legs at a core inlet and a second oscillating valve between a hot legs at a core outlet, through which a liquid semiconductor flows; and

a reciprocating pneumatic piston that compresses an inert gas to force said liquid semiconductor from a first heat extractor while lowering an inert gas pressure in a second heat extractor to enable said second heat extractor to fill with said liquid semiconductor warmed by passage through said nuclear voltaic cell reactor core, wherein heat is removed from said liquid semiconductor when it flows through said first heat extractor and said second heat extractor;

wherein the combination of said first and second oscillating valves, said reciprocating pneumatic piston, and said first and second heat extractors provides continuous quiet cooling of said nuclear voltaic cell reactor core and heat removal from said liquid semiconductor emerging out of said hot legs.

60. A nuclear voltaic cell reactor core according to claim 59, wherein a dynamic refueling port is connected to a one of said first or said second heat extractors and a fissile material is added to said liquid semiconductor as it flows through said dynamic refueling port.

61. A nuclear voltaic cell reactor core according to claim 59, further comprising:

a scrubber connected to a one of said first or said second heat extractors, wherein said liquid semiconductor flows through said scrubber and a portion of unwanted fission fragments and neutron activation products are removed from said liquid semiconductor by said scrubber.

62. A nuclear voltaic cell reactor core according to claim 59, wherein said nuclear voltaic cell array comprises a plurality of nuclear voltaic cells, wherein said plurality of nuclear voltaic cells each comprise at least a first metallic contact layer with a layer of fissile material deposited thereon, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor.

63. A nuclear voltaic cell reactor core according to claim 59, wherein said nuclear voltaic cell array comprises a plurality of nuclear voltaic cells, wherein said plurality of nuclear voltaic cells each comprise at least a first metallic contact layer with a layer of radioactive isotope deposited thereon, and a second metallic contact layer positioned facing said first metallic contact layer, with a liquid semiconductor interposed in between, wherein said first metallic contact layer forms a Schottky contact with said liquid semiconductor, and said second metallic contact layer forms a low resistance or ohmic contact with said liquid semiconductor.

64. A method of direct conversion of nuclear energy to electrical energy comprising the steps of:

placing a liquid semiconductor between two metallic contacts, wherein said first metallic contact creates a low resistance or ohmic contact with said liquid conductor and said second metallic contact creates a Schottky contact with said liquid semiconductor;

placing nuclear material in close proximity to said liquid semiconductor; and

creating an electrical circuit between said first metallic contact and said second metallic contact.

65. A method for directly converting nuclear fission energy into electrical energy, the method comprising the steps of:

depositing a layer of nuclear fissile material on a substrate;

depositing a metallic contact layer onto said layer of nuclear fissile material;

depositing a second metallic contact layer onto a second substrate;

placing a liquid semiconductor between said first and said second substrates so that said liquid semiconductor is in contact with said first metallic contact layer and said second metallic contact layer;

creating a Schottky contact between said first metallic contact and said liquid semiconductor;

creating an ohmic contact or low resistance contact between said second metallic contact and said liquid semiconductor;

creating an electrical circuit between said Schottky contact and said ohmic contact; and

removing an electrical energy from said electrical circuit, said electrical energy being generated as a consequence of a release of nuclear energy by said fissile material causing a plurality of electron-hole pairs to be created in said liquid semiconductor, wherein said electrical energy is generated as a result of current flow between said Schottky contact and said low resistance or ohmic contact.

66. The method of claim 65 further comprising the step of:

placing said nuclear voltaic cell in contact with a coolant and circulating said coolant in a closed system to remove heat from said nuclear voltaic cell.

67. The method of claim 66 further comprising the step of:

placing said nuclear voltaic cell in a closed system and pumping said liquid semiconductor through said nuclear voltaic cell and around said closed system.

68. The method of claim 67 further comprising the step of:

removing heat from said liquid semiconductor by placing a heat extractor in said closed system and pumping said liquid semiconductor through said heat extractor.

69. The method of claim 68 further comprising the step of:

removing unwanted fission fragments and unwanted neutron activation products from said liquid semiconductor by placing a scrubber in said closed system and pumping said liquid semiconductor through said scrubber.

70. A method for directly converting nuclear fission energy into electrical energy, the method comprising the steps of:

placing nuclear fissile material in solution in a liquid semiconductor;

sandwiching said liquid semiconductor containing said fissile material between a first and second metallic contact;

creating a Schottky contact between said first metallic contact and said liquid semiconductor;

creating a low resistance or ohmic contact between said second metallic contact and said liquid semiconductor;

creating an electrical circuit between said Schottky contact and said ohmic contact; and

removing an electrical energy from said electrical circuit, said electrical energy being generated as a consequence of a release of nuclear energy by said fissile material causing a plurality of electron-hole pairs to be created in said liquid semiconductor, wherein said electrical energy is generated as a result of current flow between said Schottky contact and said low resistance or ohmic contact.

71. The method of claim 70 further comprising the step of:

placing said nuclear voltaic cell in contact with a coolant and circulating said coolant in a closed system to remove heat from said nuclear voltaic cell.

72. The method of claim 70 further comprising the step of:

placing said nuclear voltaic cell in a closed system and pumping said liquid semiconductor through said nuclear voltaic cell and around said closed system.

73. The method of claim 72 further comprising the step of:

removing heat from said liquid semiconductor by placing a heat extractor in said closed system and pumping said liquid semiconductor through said heat extractor.

74. The method of claim 72 further comprising the step of:

removing unwanted fission fragments and unwanted neutron activation products from said liquid semiconductor by placing a scrubber in said closed system and pumping said liquid semiconductor through said scrubber.

75. The method of claim 74 further comprising the step of:

adding fissile material to said liquid semiconductor to replace fissile material exhausted by fission events.

76. A method for directly converting nuclear fission energy into electrical energy, the method comprising the steps of:

arranging a plurality of nuclear voltaic cells in close proximity to each other; and

connecting said plurality of nuclear voltaic cells so that an electrical output of said nuclear voltaic cells is combined.

77. A method for directly converting nuclear fission energy into electrical energy, the method comprising the steps of:

connecting a plurality of nuclear voltaic cells so that an electrical output of each of said plurality of nuclear voltaic cells is combined;

surrounding said plurality of nuclear voltaic cells with a biological shield;

surrounding said biological shield with a housing; and

placing a coolant between said biological shield and said housing.

78. The method of claim 77 further comprising the step of:

removing heat from said plurality of nuclear voltaic cells by pumping said coolant through a heat extractor.